

HOW ECOSYSTEMS CHANGE

Ecosystems are constantly changing. A shallow lake can change into a forest after thousand years.

Ecological Succession: Introduction

Ecological succession is a gradual process of change and replacement of the types of species in a community. The process of ecological succession may take hundreds or thousands of years.

Each new community that arises often makes it harder for the previous community to survive. For example, the younger beech trees will have a hard time competing with the older beech trees for sun.

Primary succession is a type of succession that occurs on a surface where no ecosystem existed before. Primary succession can occur on rocks, cliffs, and sand dunes.

Secondary succession, the more common type of succession, occurs on a surface where an ecosystem has previously existed. It occurs in ecosystems that have been disturbed or disrupted by humans, animals, or by natural processes such as storms, floods, earthquakes, and volcanoes.

In 1980, the volcano Mount St. Helens erupted in Washington State. This resulted in the destruction of forest. After the eruption, plants began to colonize the volcanic debris. Such plants are called pioneer species.

Over time, pioneer species will make the new area habitable for other species.

If we visit Mount St. Helens today, we would find that the forest is in the process of secondary succession. Plant and flowers had covered much of the lava and new trees and shrubs had started to grow. If these organisms at Mount St. Helens continue to grow, over time they will eventually form a climax community.

A climax community is a final and stable community. Even though a climax community continues to change in small ways, this type of community may remain the same through time if it is not disturbed.

FIRE AND SECONDARY SUCCESSION

Natural fires caused by lightening are a necessary part of secondary succession in some communities. Some species of trees, such as the Jack Pine, can release their seeds only after they have been exposed to the intense heat of a fire.

Minor forest fires remove accumulations of brush and deadwood that would otherwise contribute to major fires that burn out of control.

Some animal species also depend on occasional fires because they feed on the vegetation that sprouts after a fire has cleared the land.

Therefore, foresters sometimes allow natural fires to burn unless the fires are a threat to human life or property.

Some fires are set on purpose by fire officials to bring nutrients to soil from burned vegetation.

OLD-FIELD SUCCESSION

Old-field succession is an example of secondary succession. It occurs when farmland is abandoned. When a farmer stops cultivating a field, grasses and weeds quickly grow and cover the abandoned land. The pioneer grasses and weeds grow rapidly and produce many seeds to cover large areas.

Then over time, taller plants, such as perennial grasses, grow in the area. These plants shade the ground, which keeps light from the shorter pioneer plant. The long roots of the taller plants also absorb most of the water in the soil and deprive the pioneer plants of adequate water to survive. The pioneer plants soon die from lack of sunlight and water. As succession continues, the taller plants are deprived of light and water by growing trees.

Finally, slower-growing trees, such as oaks, beeches, and maples take over the area and block out the sunlight to the smaller trees.

After about a century, the land can return to the climax community that existed before the farmers cleared it to the plant crops.

PRIMARY SUCCESSION

On new islands created by volcanic eruptions, in areas exposed when a glacier retreats, or on any other surface that has not previously supported life, primary succession can occur.

Primary succession is much slower than secondary succession because it begins where there is no soil. It can take several hundred to several thousand years to produce fertile soil naturally.

The first pioneer species to colonize the bare rock will probably be bacteria and lichens, which can live without the soil.

Lichens are important early pioneers in primary succession. A lichen is a producer that is actually composed of a fungus and an alga. The alga photosynthesizes, while the fungus absorbs nutrients from rocks and holds water. Together, they begin to break down the rock.

As the growth of the lichen breaks down the rock, water may freeze and thaw in cracks, which breaks up the rock further.

Soil slowly accumulates as dust particles in the air are trapped in cracks in the rock. Dead remains of lichens and bacteria also accumulate in the cracks.

Mosses may later grow larger and break up the rock even more.

When the mosses die, they decay and add material and nutrients to the growing pile of soil.

Thus fertile soil forms from the broken rock, decayed organisms, water and air.

Ecological Succession Worksheet

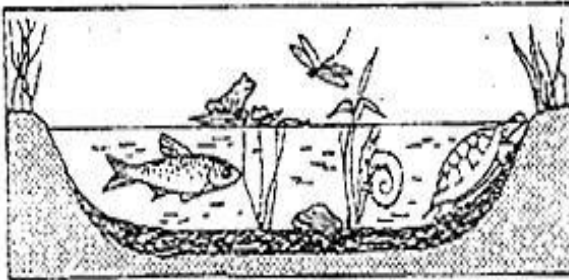
Name _____

A. Compare & Contrast Primary & Secondary Succession.

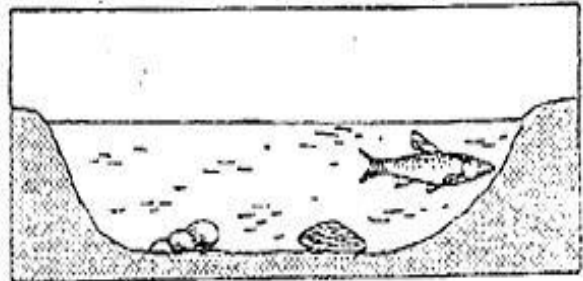
B. Evaluate the role of fire in ecosystems. What are the good sides & bad sides?

The water level of Lake Michigan was once 18 meters higher than it is today. As the water level fell, land was exposed. Many small lakes or ponds were left behind where there were depressions in the land. Below are illustrations and descriptions of four ponds as they exist today. Use the illustrations and descriptions to answer the questions about the ponds.

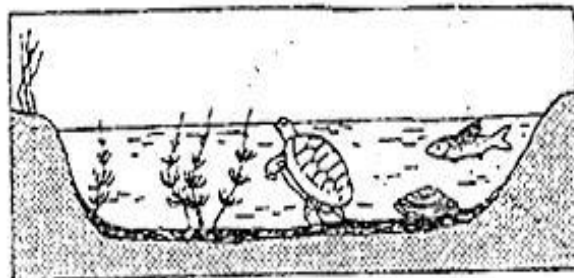
Pond A



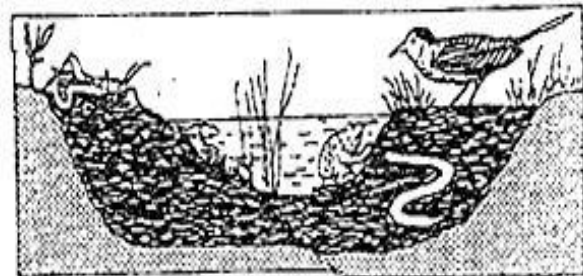
Pond B



Pond C



Pond D



Pond A:

Cattails, bulrushes, and water lilies grow in the pond. These plants have their roots in the bottom of the pond, but they can reach above the surface of the water.

This pond is an ideal habitat for the animals that must climb to the surface for oxygen. Aquatic insect larvae are abundant. They serve as food for larger insects, which in turn are food for crayfish, frogs, salamanders, and turtles.

Pond B:

Plankton growth is rich enough to support animals that entered when the pond was connected to the lake. Fish make nests on the sandy bottom. Mussels crawl over the bottom.

Pond C:

Decayed bodies of plants and animals form a layer of humus over the bottom of the pond. Chara, branching green algae, covers the humus. Fish that build nests on the bare bottom have been replaced by those that lay their eggs on the Chara.

Pond D:

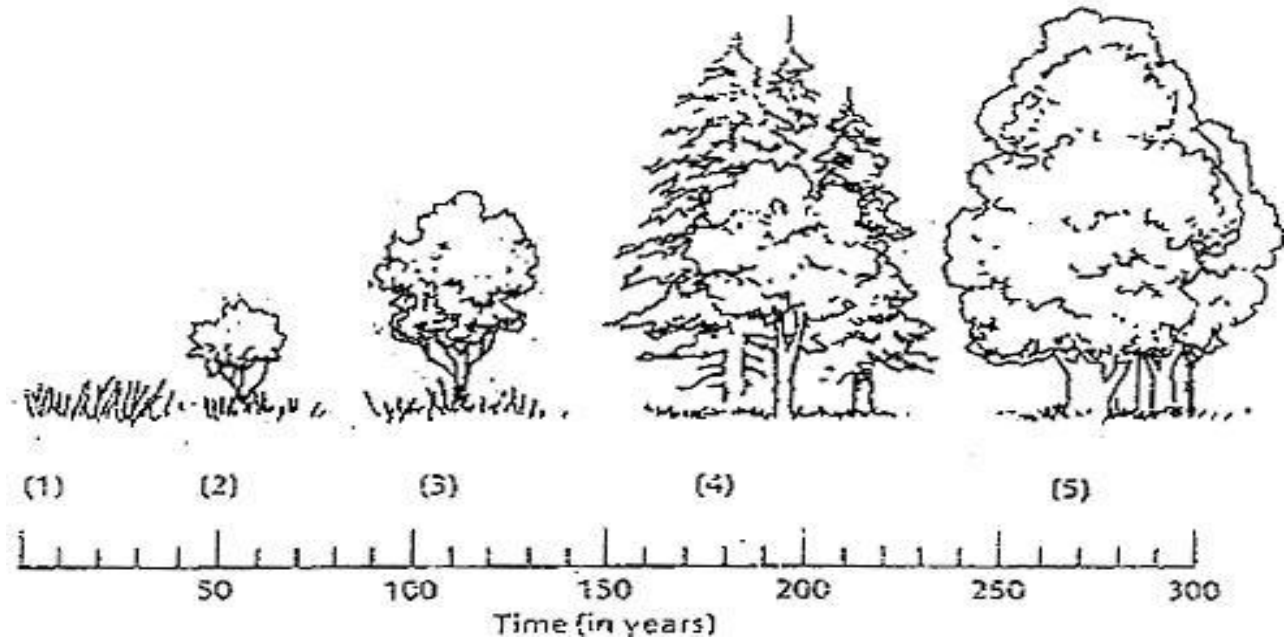
The pond is so filled with vegetation that there are no longer any large areas of open water. Instead, the pond is filled with grasses. The water dries up during the summer months.

Lake Michigan Pond Questions:

1. Write the letters of the ponds in order from the youngest, to the oldest.
2. Black bass and bluegill make their nests on sandy bottoms. In which pond would you find them?
3. What will happen to the black bass and blue gill as the floor of the ponds fills with organic debris?

4. Some amphibians and crayfish can withstand periods of dryness by burying themselves in mud. In which pond(s) would they survive?
5. Dragonfly nymphs spend their early stages clinging to submerged plants. Then, they climb to the surface, shed their skins, and fly away as dragonflies. Which pond is best suited for dragonflies?
6. In which pond will gill breathing snails be replaced by lung breathing snails that climb to the surface to breathe?
7. Some mussels require a sandy bottom in order to maintain an upright position. In which pond will they die out?

The climax community in the area of Arkansas is an oak-hickory forest. After the ponds are filled in, the area will undergo another series of stages of succession. This is illustrated below. Briefly explain what is happening in the diagram.



1.

2.

3.

4.

5.